FUNCTIONING & EFFECT OF SUPPLY CHAIN MANAGEMENT ON APPLES GROWERS: AN EMPIRICAL STUDY IN H.P

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Introduction

India is the world's most populous nation with a population of 1.42 billion. With an area of 3.288 million sq kms it is the seventh largest country of the world. The nation is a abode to vast agro-ecological diversity with the highest mountain range in the world, the Himalayas to its North, the Thar desert to its West, the Gangetic delta to its East and the Deccan Plateau in the South.

Agriculture, with its allied sectors, is the major source of livelihoods in India. Seventy percent of its rural households still depend primarily on agriculture for their livelihood, with 86 percent of farmers being small (17.62%) and marginal (68.45%). The total food grain production estimated to be was 330MT (2023-24). India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) of pulses in the world producing 27.69MT. India's annual milk production was 209.96 MT (2021-22), which makes India the largest producer of milk, jute and pulses, and with world's largest cattle population 308 million in 2022 and accounts for 12% of the world fruit and vegetable production.

(Stein, 1998) The First Green Revolution in 1967-68 arose from the introduction of new high yielding varieties of Mexican Wheat and dwarf rice varieties, the Second Green Revolution from 1983-84 was said to be from expansion in supplies of inputs and services to farmers, agricultural extension and better management. While the First Green Revolution was limited mainly to Punjab, Haryana and Western U.P., the Second Green Revolution had spread to eastern and central states including West Bengal, Bihar, Orissa, Madhya Pradesh and Eastern U.P. Tremendous progress in terms of growth of agriculture has been witnessed in recent years.

Amid 1965 and the early 1980s the major benefits of the Green Revolution were experienced mainly in northern and northwestern India; the program brought about a substantial increase in the production of food grains, mainly wheat and rice. There was a tremendous increase the food grain yield in 1980s but it could not replicate the dramatic changes which took place between 1965 and 1980. By FY 1980, almost 75 percent of the total cropped area under wheat was sown with high-yielding varieties. For rice the comparable figure was 45 percent. In the 1980s, the area under high-yielding varieties continued to increase, but the overall rate of growth was slower. The eighth plan was designed aiming at making high-yielding varieties available to the whole country and developing more productive strains of other crops.

Under the rural development programme, White Revolution was started by India's National Dairy Development Board (NDDB) in 1970. This was one of the largest of its kind, and the objective was to create a countrywide milk grid. It made India the largest producer of milk and milk products, and hence is also called the White Revolution of India. It also helped reduce malpractices by milk traders and merchants.

The growth, development and adoption of new varieties of oilseeds and complementary technologies nearly doubled oilseeds production, catalyzed by the Technology Mission on Oilseeds, brought about the Yellow Revolution.

Rainbow revolution concept is a combination of Green Revolution, White Revolution, Blue Revolution (Fisheries), Yellow Revolution and Brown Revolution (turning garbage which is brown into gold and fertilizer). It was after these revolutions, the Indian agriculture slowly shifted from traditional behavior to scientific behavior (Stein, 1998).

After effective implementation of Green Revolution, White Revolution, Blue Revolution, Yellow Revolution and a combined concept of Rainbow Revolution, India ranks second worldwide in farm output. Agriculture and its allied sectors like forestry and logging accounts for 18.3% of the GDP in 2022-23,

In the Indian economy, the agricultural sector which plays a critical role and has undergone massive structural changes, with its share of gross domestic product (GDP) falling from 30% (1990-91) to 18.3% (2022-23), indicating a shift away from the traditional agrarian economy and toward a service-oriented economy(Government of India, Ministry of Agriculture & Farmers Welfare, 2022).

However, the agriculture sector continues to employ near half of the total workforce and is a primary source of income for approximately 44% of India's population (WORLD BANK). Despite a steady decline in its GDP share, agriculture remains India's most important economic sector and an important component of the country's overall socioeconomic development.

Agricultural Diversification

In recent years, the composition of India's agriculture and allied sectors is changing structurally, resulting in agricultural diversification into horticulture sector. India has witnessed increase in horticulture production over the last few years. Significant progress has been made in area expansion resulting in higher production. During 2021-22, production of horticulture crops was 342.32 '000 Tonnes from an area of 28.76 million ha. The production of vegetables has increased from 183.17 '000 MT to 204.83'000 MT between 2018-19 and 2021-22 and production of fruits has increased from 97967 '000 MT to 107242 '000 MT between 2018-19 and 2021-22(Government of India, Ministry of Agriculture & Farmers Welfare, 2022)

Farmers' migration to the horticulture sector can be attributed to the fact that there has been a tremendous increase in demand for fresh F&V in organised markets. According to data from the Government of India, there has been a 1-2% decline in rice and wheat consumption patterns in India, both by rural and urban populations, while there has been a significant increase of 2-3% in demand for F&V and the increase in demand is attributed to changes in dietary habits, increased per capita Income and largely to Urbanisation, Globalization & population increase (P. Pingali, 2019; Reardon et al., 2009a)

As incomes rise, Indian consumers are diversifying their diets to include a broader array of foods. With this diversification, dietary patterns that mirror global trends are beginning to emerge. Since the early 1990s, non-staple foods including dairy products, meats, edible oils, fruits, and vegetables have been the fastest growing food categories in India (Pandey et al., 2013a). The increased consumption of foods in these categories is due to the rise in dual-income families, rising income levels, and globalization (P. L. Pingali, 2004). With a growing organized retail infrastructure, growing consumer awareness about healthy eating, and established perceptions about F&V as a healthy and flavorful option, the Indian market for F &V has huge growth potential.

The increased share of horticulture in agriculture and allied suggests that it has been growing much faster than the traditional crop sector. Prior to a few decades, the situation was completely different, with horticultural crop production being significantly lower. Since the area covered by horticultural crops increased significantly to 28.76 million ha in 2021-22, up from 16.59 million

ha in 2001-02, horticulture production has increased dramatically, rising from 145.78 million tonnes to 342.32 million tonnes. Thus, from 2001-02 to 2021-22, there has been a significant increase in the area (40%) and production (78%) of horticulture crops Agricultural Statistics at a Glance ,2022). Over the last 20 years, the total amount of land available for horticulture production has more than doubled.

A Need for Effective Supply Chain Management

Supply chain management is crucial to ensure that corporate expenses are kept to a minimum and profitability is maximised. Supply Chain Management refers to the administration of the entire set of creation, manufacturing/changes, distribution, and marketing activities that ensure a buyer receives a product. The executives of the store network are in charge of all activities related to sourcing, acquisition, transformation, and coordination. It also includes coordination and collaboration with channel partners, who could be providers, middlemen, outsider specialist organisations, or clients.

Indian agricultural marketing system is suffering from various problems viz. improper warehousing, lack of grading and packaging, inadequate transport facilities, presence of large number of middlemen, malpractices of traders, inadequate market information and insufficient funds etc. (Saxena et al., 2017a). Wastage in the perishable fresh produce F&V supply chain from harvesting stage till it reaches the consumer is very high in emerging markets like India (Balaji & Arshinder, 2016).

There is lots of wastage during transportation, storage stages & more intermediaries leading to more hinderances. The entire supply chain of perishable food produce is fraught with the issue of post-harvest losses and wastages. Around 30-40 % of total production gets waste at various levels of the supply chain which amounts to a loss of Rs. 2 Lakh crore per annum. Apart from the loss of revenue to the farmers, it leads to increased additional costs in the supply chain which ultimately enforces the final consumers to pay high charges from his pocket.(Negi & Anand, 2015).

Nearly one-third of global food production ,1.3 billion tonnes of food is lost along the supply chain or wasted by consumers and retailers and by 2030 annual food loss and waste will hit 2.1 billion tons worth $1.5 trillion. Reducing this waste could cut costs, improve incomes, and alleviate negative impacts on the environment. Reducing food loss and waste is a way to reduce economic

costs, improve food security and nutrition, and reduce pressures on natural resources and the environment, including, in particular, the reduction of greenhouse gas emissions (World Bank, 2020).

Nevertheless, India has lot many positives when it come to the fruits and vegetable production and marketing sector, it has several disadvantages too. The country lacks an efficient supply chain for the distribution of the fruits and vegetables. To keep business costs minimum and profitability as high as possible, supply chain management plays an integral role. Many factors are involved in supply chain management of which flow is one of the most important factors. Flow comprises the product flow, the information flow and the finances flow. The product flow is the movement of goods from a supplier to a customer, as well as any customer returns or service needs. Transmitting orders and updating the status of delivery is information flow and the finance flow looks for all the financial aspects such as invoices and payments. The present challenge in supply chain management is to maintain all three flows in an efficient manner, resulting in optimal results for farmers, growers, wholesalers and customers. (Sheoran A, 2015a)

Long chain of middlemen decreases the producer's share in consumer rupee and exploit the farmers so Government made its intervention & came up with APMC Act in 2003 as a first attempt to have regulated markets, fixed charges to protect farmers' interest. But even after all these interventions government was not able to elevate farmer's problems & still the food wastage remains high.

This practice of APMCs has closed all the gates and producer could sell their produces only at regulated market yards. As a result, growers are exploited at great extent by traders and wholesalers and this intervention of intermediaries reduce the producer's share in consumer rupee (Pandey et al., 2013).

Thus, to have 'barrier-free' agricultural marketing system in country, choice of multiple and competitive market channels to farmers, independent regulatory authority to encourage private investors and smooth license & registration of traders in regulated market yards were advised. Thus, APMC Act was needed to be revised which has been evolved as amended APMC Act titled as the "State Agricultural Produce Marketing (Development and Regulation) Act, 2003" (Farmer's Forum, 2011). This legislation provided a provision for direct selling of the farm products by farmers to Contract farming firms by bypassing the mandis (Nair et al., 2022). The CF model

involves linking farmers with a known buyer (for example, an agribusiness firm, an exporter or a retail chain) through a forward contract in which the former promises to supply a certain quantity of an agricultural product to the latter within a pre-agreed time frame subject to certain conditions mutually agreed upon by the contracting parties (Barrett et al., 2012a; Singh, 2002).

Now government increased private sector partnership & private players are allowed to procure fruits & Vegetables from producers directly. A large number of Supply Chain Management groups viz. CONCOR, Field Fresh, Mahindra Shubh Labh, Adani Agri fresh, Reliance Fresh, Godrej, Adani Agri Fresh, Mother Dairy, Fresh and Healthy etc. procure directly from producers and offering SCM, storage facilities and offer healthy prices to primary producers under contract farming(Pandey et al., 2013b; Saxena et al., 2017b).

Fruits and Vegetables Supply Chain Models in India

There are three types of supply chain models in general which are used in the F&V sector in India: traditional models, hub and spoke models, and value chain models (Halder Piali and Pati Simayan,); (Negi & Anand, 2015a). All these models are discussed in detail below:

i) Traditional Model

The currently followed ‘Traditional Model' is a complex chain for the flow of F&V in supply Chain. The traditional supply chain model for F&V in India is depicted in Figure 1. Apart from farmers and customers, agents (commission agents), auctioneers, wholesalers, traditional retailer of all types of formats such as family run ‘mom and pop' stores, roadside shops, pavement shops, and cart vendors are the players in this model. Traders in the F&V supply chain include agents, auctioneers, and wholesalers. Farmers are the main source of F&V produce. Farmers sell their produce to retailers through various intermediaries who eat the entire market price share in this model.

The first level middlemen in this model are agents and auctioneers, who transfer F&V from producers to wholesalers. The number of F&V transfers and transshipments is determined by the number of agents present between farmers and wholesalers. Typically, wholesalers do not participate in F&V transportation, both inbound and outbound. Traditional retailers purchase F&V from wholesalers and sell to customers directly.

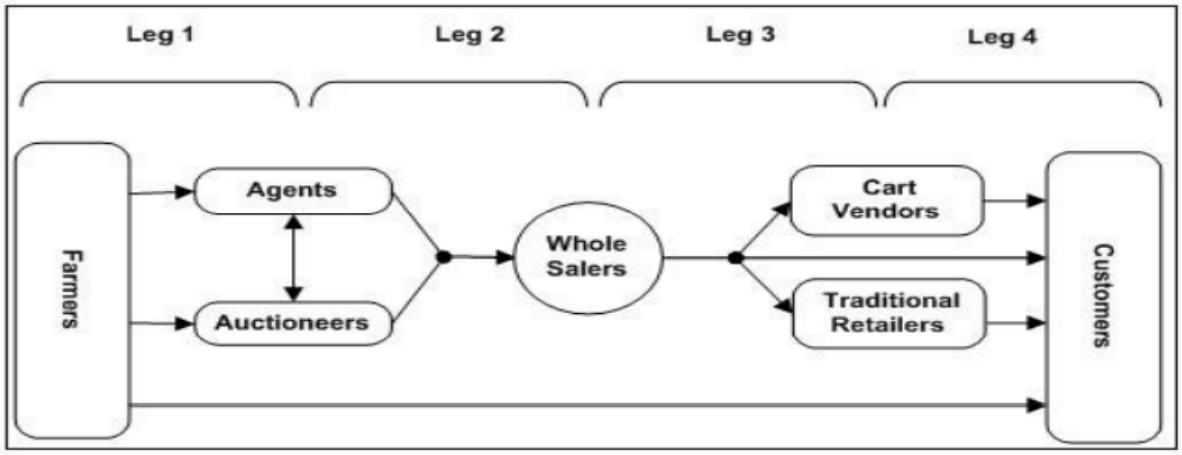

Figure 1 (Source: (Halder Piali & Pati Simayan, 2011)**)**

ii) Hub and Spoke Model

Organized retailers, including prominent players such as Food Bazaar (Pantaloons Retail, India Ltd), Spencer's Retail and More (Trinethra Super Retail Ltd.), are using the 'Hub and Spoke' Model for their F&V Supply Chain. Figure 2 depicts the F&V Supply Chain Hub and Spoke model. This type of model involves only a few players. The partners in this chain include farmers, organized retailers, wholesalers, and customers. Buying centers, hubs, and stores (retail outlets) are operational units of organized retailers in this supply chain model. In this model, small farmers and contract farmers are the primary sources of F&V supply for organized retailers. The organized retailers directly collect the F&V from the farmers and transport it to their hub, which is served by one or more buying centers, where it is then distributed to their retail outlets. To balance the demand-supply gap, Hub occasionally purchases a small quantity of produce from the local wholesale market. There is only one hub that serves a retail store. The store sells F&V to customers in retail quantities based on demand.

According to this model, F&V travel in four phases/legs: from farmers to buying centers of organized retailers, from buying centers to hubs, from hubs to organized retail stores, and finally from retail outlet to end consumer.

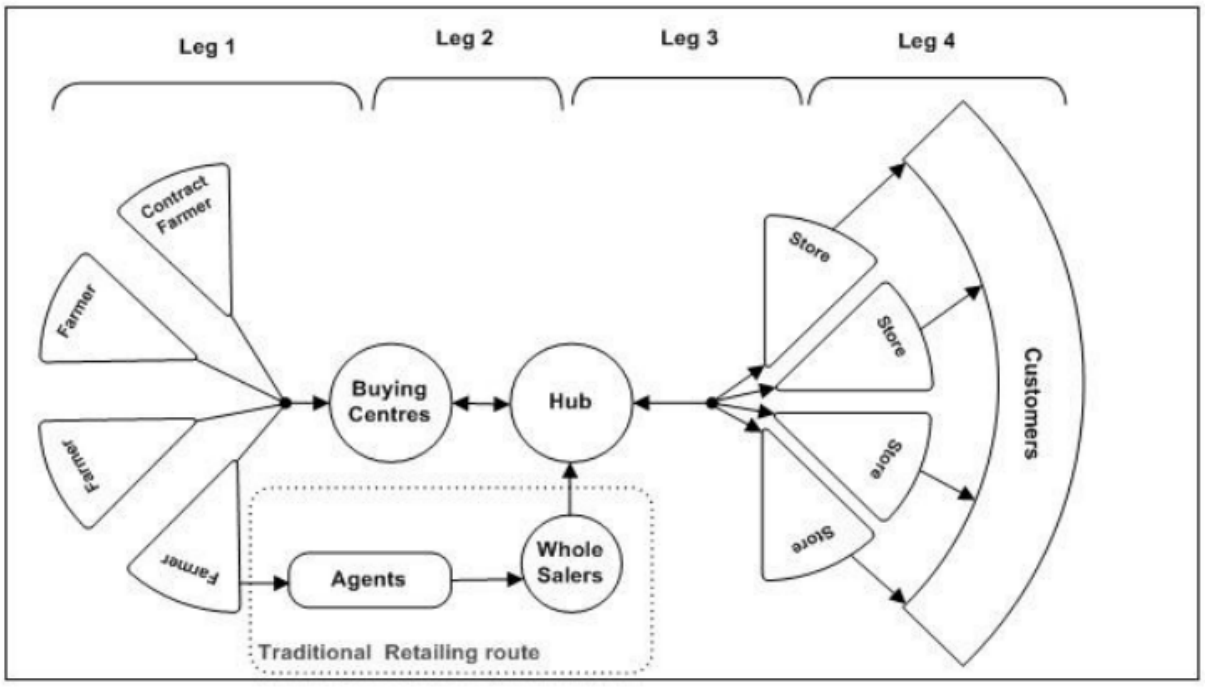

Figure 2 (Source: (Halder Piali & Pati Simayan, 2011)**)**

iii)Value Chain Model

Only a few organized retail players, such as Reliance Fresh (Reliance Retail Ltd), Adani Agri fresh, currently use a Value Chain Model. Organized retailers who use this model obtain F&V directly from farmers, either through contract farming or by leasing the farm, and sell to customers without the assistance of any intermediaries. This model works on backward integration and is aimed at constructing an entire value chain by organized retailers, beginning with farmers and ending with end users. In comparison to other supply chain models, the Value Chain Model has fewer partners, namely farmers, organized retailers, and customers. Farmers, organized retailer operational units, consolidation centers, hub (distribution centers), retail outlet stores, and customers are the players in this practice.

Small farmers, contract farmers, and lease farmers supply the majority of F&V to organized retailers. Contract farmers and lease farmers are farmers who enter into a trade agreement for the sale of F&V with organized retailers. Figure 3 depicts the Value Chain Model of India's F&V supply chain. Farmers to consolidation centers, consolidation centers to the hub, hub to retail outlets (stores), and stores to customers are the four stages in which F&V moves from farm

locations to customers. Customers purchase and collect fresh F&V from organized retail stores. In this model, stores with a smaller coverage area and a high purchase value offer home delivery.

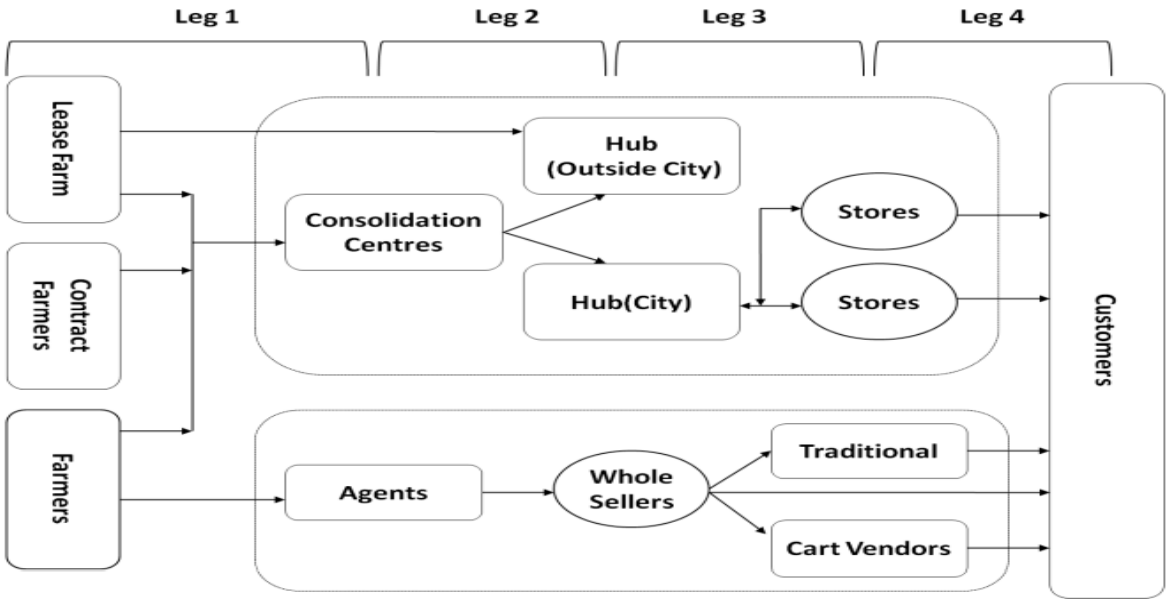

Figure 3 (Source: (Halder Piali & Pati Simayan ,2011)**)**

Himachal Pradesh: State Overview

Himachal Pradesh, known for its pristine beauty, is one of the most visited state in the Northern India and is bordered by Jammu & Kashmir on north, Punjab on west, And South-West, Haryana on south, Uttarakhand on South East and China on East (Goverment of Himachal Pradesh, 2019) Himachal Pradesh has been gifted with a wide range of agro climatic conditions which leads to production of a large number of horticulture commodities like fruit crops (from temperate to sub-tropical), flowers, vegetables, mushrooms, hops, tea, medicinal & aromatic plants etc. Amongst the fruit crops, perhaps all kind of fruits grown in the country, except those which are grown in the warm humid coastal regions, can be produced in the State[2]. The state contributes 753.98 million Tonnes of fruits and 199.89 million Tonnes of vegetables in terms of production (Statistical Year Book, 2021).

The State is broadly divided into four agroclimatic zones depending upon the agroclimatic conditions and the suitability of a particular area for the growing of specific fruit crops in that area, as Zone I ranging from 365-914 mts. (Low hills), Zone II ranging fom 915-1523 mts. (Mid Hills),

Zone III from 1524-2742 mts. (High Hills) and Zone IV ranging from 2742-3656 mts. (Cold & Dry Zone)

Agricultural diversification towards fruit and vegetable crops in Himachal Pradesh, especially in some areas in the districts of Shimla, Kullu, Solan, and Lahaul and Spiti, started in the late sixties and continued in the seventies and the eighties. The process of crop diversification gained momentum in the nineties and has now encompassed many new areas in the low and mid-hill districts (Sharma H R, 2011). Due to the tourism industry, diversification from cereal-based cropping system to vegetables is gaining momentum in the state. More area is being used to cultivate exotic vegetables on account of suitable temperate climate which has proven to be a remunerative venture. At present, the area under vegetable farming in the state is 86,821 hectares and production is 18 lakh tones, with a growth rate of 17.4% in area and 14.4% in production from 2014-15. (Statistical Year Book, 2021) Vegetable productivity of Himachal Pradesh is 19.5 tonnes per hectare which is higher than the national productivity of 17.5 tonnes per hectare. [2]

State has tremendously doubled its fruit production from 372.82 MT (2011-12) to 753.98 MT (2021-22) in the last decade(Statistical Year Book, 2021). Himachal Pradesh, with its abundance of scenic areas, attracts thousands of international and domestic tourists every year. And while tourism is a major industry, drug manufacturing capacity and the ability to grow fruits and vegetables really turns the wheels of the state's economy.

Besides, Himachal ranks second in the production of apples and almonds in the country. It is also one of the largest producers of off-season vegetables like capsicum, tomato, peas, cabbage, and cucumber, and exotic fruits like persimmon and kiwi. This is the reason Himachal is also called the "Fruit and vegetable bowl of India".[3]

Review of Literature

A review of the literature is a necessary step before beginning any research. It not only provides the researcher with existing knowledge about theories, research status, and methodologies on a specific research topic, but it also assists in identifying gaps in the existing literature. The critical review of literature contributes to the study's foundation by shedding light on unresolved issues.

The literature review aids in the development of research objectives, the formulation of a research design, the selection of variables, and the creation of a questionnaire. An extensive literature review was conducted in accordance with the objectives.

Wilson, (1996b) examines the concept of SCM using a study conducted in a grocery market in the United Kingdom on the banana supply chain, focusing on issues related to marketing and distribution of fresh items. The study focused on three major food companies in the United Kingdom, and it discovered that vertical integration is becoming more prevalent in food retailing.

The author demonstrates how supply chain theory has evolved from neoclassical theories to a new business paradigm. He argues that increasing coordination in the fresh produce supply chain can provide a competitive advantage.

Sheoran A, (2015b) studied the scope of supply chain management in fruits & vegetables in India & found that high level of wastage, quality degradation, poor infrastructural facilities & high costs are the major drawbacks of the current supply chain.

The study also revealed that considering the perishable nature, seasonality & delicate nature of fruits & vegetables coupled with inadequate storage & transport facilities, the supply chain needs to be made efficient by reducing the length of the chain & improving cold chain facilities. The supply chain management in F&V is to be improved by adopting global best practices in storage, packaging, handling, transportation, value added services and also by disintermediation and participation of organized players i.e. modern supply chain with a view to benefit both farmers as well as ultimate consumer.

The author reports that the initiative will ensure consistency in supply and provide recorded and demonstrated traceability of products. It will benefit the farmers with good remunerative price and

consumers with good quality produce and also will reduce the losses incurred due to poor post-harvest management and thereby ensuring adequate supply to consumers.

Negi & Anand, (2015b) conducted a study to examine the issues & challenges in the supply chain of fruits & vegetables and found that Cold Chain Facilities; Fragmented Supply Chain; Linkages and Integration between the partners; Taxation Issue; Infrastructure Facilities; Cost of Packaging Material; Technology and Techniques; Farmer's Knowledge and Awareness; Quality and Safety standards; Processing and Value Addition; Supply Chain inefficiency; Farmers income; Supply chain losses and wastage of fresh produce; Transportation facilities; Demand and market information etc. are the factors which constitute serious challenges for Fruits and Vegetables sector and are affecting the overall growth of the agricultural development of India.

Balaji & Arshinder, (2016) identified and analysed the causes of losses and waste in the food sector. The authors identified 16 main reasons, as well as several other causes within its domain causing wastage in fruits & vegetables supply chain. The lack of scientific harvesting methods and the presence of a greater number of intermediaries in the supply chain are primarily regarded as the root causes of food waste and losses. The author concluded that more cold storage facilities should be built by public- private partnerships.

Raut et al., (2019) found that the majority of food losses occur in the fruit and vegetable supply chain as a result of low quality and a mismatch between supply and demand. Food losses from fruits and vegetables are caused by inappropriate handling and a lack of proper cold transportation, such as cold logistics facilities/providers or insufficient infrastructure. The authors defined five criteria and thirty sub-criteria for reducing losses in the fruits and vegetables supply chain, as well as a model for reducing food losses by evaluating and selecting cold-third-party logistics providers (CTPLs).

Negi & Anand, (2019) explored factors leading to supply chain inefficiency with respect to cost, time & quality which are ultimately leading to huge amount of losses and wastage. The study identified 3 latent factors for high cost, 4 factors for high lead time and poor quality. The factors are operational charges, labor, operational issues, infrastructure and poor ambience. The most significant factors leading to supply chain inefficiency are high operational issues & operational charges. This study shows that considering the current wastage of F&V, well design supply chain plays an important role in feeding the country population and help to improve the revenues and

livelihood of the farmers. They found that development of cold chain infrastructure and food processing units will help to improve the scenario of agriculture sector and will give better returns to the farmers.

Reardon, (2015) Investigated the transformation of the midstream of food value chain in developing countries, India and Indonesia. The author found that there is emerging evidence that the midstream structure and behavior is rapidly changing. This change is driven mainly by private sector investment by both large and small enterprises, encouraged by transformation in upstream and downstream in the food system and facilitated by policy reforms. The study reveals that areas near cities experience more rapid transformation of food value and diet transformations, one as income have risen and there has been a shift in the food expenditure, second rural consumption has rapidly commercialized (i.e. the share of purchased food in the total food consumed has risen) and third a rapid penetration of both low and high processed foods (such as wheat noodles) as well as prepared foods sold in restaurants is also seen.

Reardon et al., (2009b) discussed the agrifood Industry transformations in developing countries and their impact on farmers. They found that from 1980's to 2000 there has been rapid restructuring in agrifood industry. They have mentioned in their study that in many situations the transition effect of food industry transformation to farmers is relatively week in some countries such as China etc. They further added that medium and large farmers are equipped to face this transformation and small farmers can also improve their produce via modernizing markets but they are lacking in access to non-land assets such as irrigation, access to road, to associations, to greenhouse etc. so do not form the part of inclusion. The study reveals that inclusion in modern channels has a positive impact on small farmers' revenues and assets.

Pandey et al., (2013b) analyzed the challenges faced by Adani Agrifresh regarding their apple business in Himachal Pradesh. Sourcing supply from farmers, capacity utilization, and assortment of products are the major issues with which the firm is dealing. They found that there are three different business models in action for the procurement and distribution of apples, one Commission agents in traditional APMC markets, second, semi-direct company buyers & third, direct company buyers each having its own pros & cons.

Kumar et al., (2021) suggested that immediate action is required to integrate and restructure the horticulture production and value chain system, which will improve the production of better and more nutritious meals and farmer income. Farmer Producer Organisations (FPOs) and agricultural start-ups will likely play key roles in the next years. The author concluded that horticulture industry is currently facing post-harvest losses, a lack of storage infrastructure, price seasonality, and market instability.

Kummu et al., (2012) analyzed the total losses and waste within the different steps of food supply chain (production, post- harvest, processing, distribution and consumption). The author also quantifies the potential food supply and resource savings that could be made by reducing food losses and waste. It was found that one quarter of the produced food supply is lost within the food supply chain. The study reveals that the production of the wasted food crops accounts usage for 24% of total fresh water resources, 23% of total global crop land area and 23% of total global fertilizer in food crop production. Sub-Saharan Africa (freshwater and fertilizers) and industrialized Asia (crop land) contributes to the smallest per capita use of resources for food losses. A more effective supply chain could arrest roughly half of the losses and 1 billion additional people could be fed if food crop losses were cut in half .

Bachke, (2019) investigated the impact of farmer's organization memberships on economic welfare among small holders. The study focused on the impact of membership on household's marketed surplus, agricultural production and total income. The impact on the value of agricultural production is 18% and on total income is 15% respectively. The impact on the marketed surplus is highest among all to 25%. The study shows that farmer organizations contribute positively to enhance welfare.

Gómez & Ricketts, (2013) have examined the transformation of food value chains in the developing countries and the relationship of these FVC's and malnutrition. The author explored that the food value chains in the developing countries are changing rapidly. The study reveals that modern food value chain may promote over- nutrition and reduce micronutrient deficiencies among middle- and high-income individuals. Whereas traditional FVC's plays a vital role in providing micronutrients foods to low income people in urban and rural areas. Another important aspect that comes to light is that traditional FVC's are unable to assist in micronutrient deficiency

reduction due to lack of post-harvest and distribution infrastructure. There is a need of improving the efficiency of traditional FVC's which will assist urban and rural poor population to access micronutrient rich food.

Hernandez et al., (2015) focused on the rapid development of Mexico's "modernizing wholesale channel" of guava traders and growers and discovered that, in comparison to the traditional broker channel, membership in the modern wholesale channel necessitates more land, regional, and nonland assets, as well as gives controlling for quality and stimulates employment in harvesting and handling locally.

Author et al., (2014) explored that modern cold storages have grown dramatically and rapidly in Bihar, one of India's poorest states and a region dominated by smallholders between 2000 & 2009 from 195 to 320 in district Vaishali & Samastipur. A triple & fivefold increase is seen in the total capacity of the cold storages in these districts. Market reform, investment subsidies, and improved overall public service provision and governance are the factors which contributed to the boom of cold storages in the state. Removal of restrictive clauses following the repeal of APMC Act in 2006 also contributes to the rise of cold storages. It was found that the sales price after cold storage are higher than the prices in harvest period and benefits the farmers balancing the monetary cost of cold storage. The total post-harvest potato wastage is 8% in the harvest period and 9.3% in the off-season that enters the value chain, have come down lower than the estimates in some previous years.

Minten et al., (2021) investigated post-harvest losses (PHL) in Ethiopia's crucial and quickly increasing rural-urban value networks. They examined self-reported PHL from various value chain agents – farmers, wholesale traders, processors, and retailers – using unique large-scale data sets for two major commercial commodities, storable staple teff and perishable liquid milk, and discovered that the emerging modern retail sector in Ethiopia has half the level of PHL than is observed in the traditional retail sector. It was found that total PHL in the entire teff value chain is between 2.3 & 3.3% of grains produced. The losses in raw milk value chain are at 2.1% and for pasteurized milk are at 4.3% due to longer value chains than raw milk. At retail level highest of all the PHL for perishable fruits & vegetables is between 2.6 and 11.8% followed by cereals is

between 0.5 and 2.0% and then for processed foods is between 0.1 and 0.5 %. The study reveals that the overall estimated PHL is lower than the commonly assumed PHL except for fruits & vegetables. 57% of farmers reported that loss of 3.1% of total harvest occurs during threshing process. 2% Storage losses were reported by 12% farmers and no losses were reported during transportation. The factors contributing to reduction in PHL are strict quality requirements leading to better packaging, better refrigeration, & storage facilities.

Nuthalapati et al., (2020) discovered that 23% of the total sample farmers are selling the vegetable to supermarket collection centers. There are few regional differences in this percentage, in South and the West it is higher at 30% and in North and East is even below than 20%. 61% of the vegetable transactions take place under traditional market transactions in public wholesale markets (mandis). This study reveals that farmers selling to supermarkets have more years of schooling, a higher share of land under irrigation and vegetables and most important have significant higher profit then the traditional farmers. The study reveals that the transaction cost in selling produce to super markets is 70% lower than traditional markets. Surprisingly this is due to the proximity of supermarket collection centers and the mandis. Result clearly shows that the presence of supermarkets is helping to modernize the supply chains by focusing on market efficiency and higher quality production.

Chandrasekhara Rao et al., (2017) examine domestic value chains and disruptive innovations at various nodes in the value chain framework as they interact with innovation systems. They provided endogeneity corrected evidence on the effects of supermarket procurement in the country's semi-arid region. Globalization forces, changing demand patterns as rise in incomes and urbanization, rapid advances in information and communication technologies, and transformative roles for institutional actors in the state, private sector, and civil society have all altered the landscape of agricultural production and marketing in recent years. The interactions in food value chain among the retailers, wholesalers, processors, logistics, cold storages, farmers & consumers have now increased due to rise of supermarkets.

Narrod et al., (2009) did a study to compare the ways in which small producers of fruits and vegetables in Kenya and India have coped with increased demands for food safety from their main

export markets. The study adds to the existing literature of successful participation of small farmers in high value export markets. The two case studies considered here revealed that collective action and public-private partnerships in the initial stages play a significant role in ensuring that small holders are included. Author found that since selling in developed markets with food safety standards requires considerable market knowledge so farmer groups need to be able to work with other agents who can provide appropriate expertise. Such associations also provide extension series to the farmers as trainings, cold storage facilities etc.

The extant literature on supply chain management of fruits & vegetables in India does not analyze the changes in various factors from retail supply chain perspective on the farmers.

This study focuses on retail supply chain dealing with apples & attempts to trace their functioning & associated impacts on the participating farmers.

Gaps in the literature and Rationale of the Study

Various studies have been reviewed in the above section and the studies shows that the presence of coordinated fresh produce supply chain can provide competitive advantage. The existing traditional supply chain of fruits & vegetables is full of various serious issues & challenges like cold chain facilities, fragmented supply chain, technology & techniques, farmer's income and many more. There are three different supply chain models for the procurement & distribution of F&V in the country each having its own pros & cons.

Studies also shows that high level of wastage, quality degradation & high costs are the drawbacks of the traditional supply chain of fruits & vegetables. The supply chain are inefficient with respect to cost, time & quality leading to huge amount of losses & wastage. Well-designed supply chain will play important role in identifying the stages/sources of high cost and wastages & suggest appropriate measures to ensure high prices to the member farmers. The analysis of supply chain within the different steps (production, post-harvest, processing, distribution & consumption) reveals that more effective supply chain could control the losses up to an extent.

Due to the presence of value chain the overall estimated post-harvest loss in commercial commodities like milk & staple teff are lower than assumed PHL. Factors like strict quality requirements leading to better packaging, better storage facilities and better refrigeration contributes in reducing the losses.

Studies also suggest that there is a transformation in the Agrifood Industry and these transformations are impacting the farmers. The policy reforms & private sector investment can be seen as rapidly changing the midstream structure of supply chain. These transformations in developing countries reveals that inclusion in modern channels has a positive impact on small farmer's revenues & assets.

The modern food value chain may reduce micronutrient deficiencies due to better post-harvest &distribution infrastructure. Integration & restructuring horticulture production & the value chain system will lead to improve the overall production, more nutrition and farmer income. Farmer's organization memberships are also contributing in a positive way to enhance farmer's welfare and is impacting household's marketed surplus, agricultural production and their total income. The rapid increase in the modern cold storages leads to higher sale prices after the prices in harvest period, benefits the farmers balancing the cost of cold storage & also reducing the post-harvest losses.

And after reviewing these studies, work done on functioning & effect of supply chain on farmers is less and few available studies done are older.

There are very few studies which have focused on the impact of modern supply chain on farmers and no thorough studies have been conducted considering the effect of these supply chain on marketing costs, access to inputs, household income, employment, consumption and livelihoods of fruit and vegetable growers.

Further we have not come across any study pertaining high value cash crops like off-season vegetable and apple that has examined the functioning of supply chain and its impact of farmers income and livelihood. Keping in view these gaps in the literature, we have planned the study with following objectives:

Objectives

1. To evaluate the functioning of different retail supply presently doing business in the state in terms of their areas of operations, crops covered, volume of business, assistance from the state and central governments, government regulations, nature of contracts with the farmers and so on.

2. To study the effect of selling fruits & vegetables through retail supply chains in comparison to traditional marketing channels on marketing costs including transaction costs, margins, and realized prices available to the participating farmers.
3. To study the effect of selling through retail supply chains on the cropping pattern, inputs use, access to inputs including technology, agronomic practices, and credit.
4. To quantify the effect of joining the retail supply chains on household income, employment, consumption and livelihoods of fruit and vegetable growers.
5. To quantify the factors which affect the farmer's decision to join the retail supply chain.
6. To document farmer's perceptions about the functioning of retail supply chains, challenges faced by the farmers & the scope for further improvements & streamlining the functioning of supply chains.

Hypothesis

1. H_{01}: Selling fruits and vegetables through retail supply chains does not significantly change total marketing costs (transaction costs, margins, and realized prices) for participating farmers compared to traditional marketing channels.
2. H_{02}: Participation in retail supply chains does not significantly alter farmers' cropping pattern, input use, access to technology, agronomic practices, or access to credit compared to non-participation.
3. H_{03}: Joining retail supply chains has no significant effect on household income, employment, consumption, or overall livelihood status of fruit and vegetable growers compared to households not linked to retail supply chains
4. H_{04}: There is no significant effect in the marketing cost including transaction cost in selling produce through different marketing channels.
5. H_{05}: There are no significant factors affecting farmers decisions to join Retail Supply Chain.

Methodology

The proposed study will be based on primary farmer household survey data, which will be conducted in Himachal Pradesh, also called the "Fruit and vegetable bowl of India".

The data in this study will be collected from both secondary and primary data sources. Secondary data for the study is gathered from several state government publications as well as records from various departments such as agriculture, horticulture, and the directorates of economics and statistics, land records, as well as from the Supply Chain Management firms of the state.
Different Supply Chain Management firms functioning in the state dealing with fruits & vegetables are identified in the different districts.

Functional Supply Chains in fruits & Vegetables in Himachal Pradesh

District	Supply Chain Firm	Commodities	No. of farmers
Kullu	Trail Blaze Fruit Company, Bhunter	Apples & Pomegranate	15-20
Kullu	Aerometrix Pvt. Ltd. Katrain	Apples	500-700
Kullu	Bija Agrifresh Pvt. Ltd. Anni	Apples	4000
Shimla	Him Agri Fresh Pvt. Ltd. Theog	Apples	200-250
Shimla	Adani Agrifresh Pvt. Ltd. Sainj, Rampur	Apples	17000-18000
Shimla	Adani Agrifresh Pvt. Ltd. Sainj, Theog		
Shimla	Adani Agrifresh Pvt. Ltd. Maindali, Rohru		
Shimla	Dev Bhumi Cold Chain Pvt.Ltd. Maitiayana	Apples	1500
Shimla	Him Fresh Produce Pvt. Ltd. Bagori,Gumna	Apples, Cherry, Plum, Pear	5000
Shimla	JCO Agrifresh Pvt. Ltd. Kachi Theog	Apples	
Shimla	Shivin CA Store, Seema Rohru	Apples	100

Shimla	Bija Agrifresh Pvt. Ltd. Bithal Rampur	Apples	4000
Shimla	Fresh Produce Impex Pvt. Ltd. Theog	Apples	500
Solan	RKS Future Foods & Cold Chain Pvt. Ltd. Baddi	Apples	25-30
Solan	Pulkit Fresh 7 Healty Ltd. Khadeen, Solan	Apples	Growers are not associated

The above table comprises of the presently functioning supply chain firms in the state dealing with dominant crop Apple & some other fruits.

Sampling & Sample Size

To select the sample, identification of functioning supply chains in the state was done where we came across that Shimla, Solan, Kullu, and Una are the districts with active supply chain firms all dealing with the fruit Apple. District Una was dropped out as all the growers associated with supply chain firms in the district are out of the state and were dealing with potatoes. Left with Shimla, Solan & Kullu which all deals in apple we decided to consider Shimla, the district with prominent and maximum supply chain firms. Supply chain firm which agreed to provide the data base of respondents, Bija Agrifresh Pvt. Ltd. covering farmers from four districts namely Kullu, Mandi, Shimla and Kinnaur with approximately 3500 farmer is selected. A proportionate sample covering all districts covered by SC firm with 360 member farmers & 100 controlled farmers, will be randomly chosen from the data provided by the Supply chain firm on basis of sample selection formula (Solvin's Formula)

$$n_0 = \frac{N}{1+Ne^2}$$

Where,

n_0 = sample size

N = 3456 (size of population)

e = 0.05% (margin of error)

$$n_0 = \frac{3456}{1+3456\ (.05)^2}$$

$$= 358.50$$

$$\approx 360$$

Data Collection

The primary data will be collected from a sample of 360 member respondents and 100 controlled respondents to manage the discrepancies if any. A well-structured schedule or questionnaire will be prepared and used to collect the data helping to achieve the objectives.

Statistical Methods

The study shall employ a synthesis of qualitative and quantitative techniques as a method to get multidimensional insights of the functioning & effects of Supply chain firms on farmers. Data will be analyzed using suitable statistical tools and techniques like averages, percentages, proportion, frequency distribution, tabular analysis and other inferential statistical tools to test hypothesis and accomplish the proposed objectives. Suitable regression model will be used to quantify the factors affecting the membership of farmers with the firms.

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CERTIFICATE
(SYNOPSIS APPROVAL CERTIFICATE)

This is to certify that the Synopsis for Ph.D. Thesis titled, **"Functioning & Effect of Supply Chain Management on Apple Growers: An Empirical Study in H.P"**, submitted by **Ms. Shivali Rathore** to the Career Point University, Hamirpur (H.P.), India in partial fulfillment of the requirements for the degree of **DOCTOR OF PHILOSOPHY** in the Department of Commerce & Management Studies, School of Management & Liberal Arts has been approved by the Research Advisory Committee (RAC) after an Oral Examination of the student on dated 05-01-2024.

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